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Structural Analysis of Semiconducting Polymers Exposed to High Energy Radiation SAEED AHMADI VASELABADI, University of Houston, NIKHILA MAHADEVAPURAM, Intel Corporation, DAVID SHAKARISAZ, University of Houston, JOSEPH STRZALKA, Argonne National Laboratory, PAUL RUCHHOEFT, GILA STEIN, University of Houston — Semicrystalline polymers are used in low-cost electronics such as solar cells, thin film transistors, and light-emitting diodes. Their optoelectronic performance in these devices is partly dictated by molecular ordering and nanoscale structure, where the latter is particularly difficult to control. We used atom-beam radiation to crosslink the polymer poly(3-hexylthiophene) into nanoscale and microscale patterns. Ionizing radiation sources generate intermolecular cross-links that render the polymer insoluble in organic solvents. Grazing-incidence Wide-angle X-ray Scattering (GIWAXS) was used to investigate the effects of irradiation on molecular ordering of poly(3-hexylthiophene). We found that crosslinking will disrupt intermolecular ordering (reduce crystallinity and crystalline grain sizes). We also found that X-ray exposure during the WAXS measurements can induce the crosslinking through a similar mechanism, and we propose a simple method to test for the damage caused by these measurements. As an example, we find that poly (3-hexylthiophene) has measurable cross-links after 20 sec exposure to 7.35 keV radiation with flux of $1 * 10^{11}$ photons/sec at an incident angle of 0.5° .

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